The Art of Tenths,

or

Decimall Arithmetike,

Teaching how to performe all Computations
whatsoever, by whole Numbers, without
fractions, by the foure Principles of
Common Arithmetike, namely, Ad-
dition, Substraction, Multiplication,
and Division.

Invented by the excellent Mathematician,
Simon Stevin.

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by Robert Norton Gent.

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Robert Norton to the *courteous Readers.*

Although I haue too often been an vnwilling witneſſe of the ouer-raſh diſpoſition of diuers vnaduiſed cenſurers, that would haue themſelues eſteemed skilfull, and yet either will not, or rather cannot doe any thing of worth themſelues, not ſparing to cauill, detract, and iniuriouſly to burthen other mens well pretended indeuours, with vnworthy and vndeſerued ſcoffes and ſcandalls: but inſtead of reading to vnderſtand, and then to examine their true validitie, that ſo with iudgement they might cenſure them, haue crittically plaid the right Momes: And though I hope not as Iacke alone, to eſcape that

which few or none haue done before me: yet the respect I haue to the publike good, that you my Countrymen, such as either want leisure or language, may become partakers of these excellent inuentions of that famous forraigne Authour, more preuailing with mee, then the careleſſe regard I haue of such iniuries could hinder, I haue, as you see, aduentured to prouide for this worthy stranger, this English welcome, and haue preferred some few of mine owne friends (though vnworthy) to accompany him:

And so commending him to your courteous entertainements, doe bid you hartily farewell.

Yours in all courteſie,

R. N.

DEFINITIONS

appertaining to Arithmeticall *whole Numbers*.

The first Definition.

ARithmeticke is the Science of Numbers.

The second Definition.

A Number is that which expresseth the quantitie of each thing.

The third Definition.

The Characters by which Numbers are denoted, are ten; namely, o signifying the beginning of Number, and 1, and 2, and 3, and 4, and 5, and 6, and 7, and 8, and 9.

The fourth Definition.

Euery three Characters of a Number is called a Member, whereof the first are the three first towards the right hand: the second, the three Characters next following towards the left hand: And so by order, for the third Member and others following, as many as there shall be found figures in the Number propounded.

The Art of Tenths, or,

The Explication.

As in the number 357876297, the 297 is called the first Member: and 876 the second; and 357 the third.

The fift Definition.

The first Character of the first Member, beginning from the right hand to the left, doth simply signifie his owne value: the second, so many times ten, as that containeth vnities: the third, so many times a hundred, as that containeth vnities: and the first Character of the second Member so many times a thousand, as that containeth vnities: and so by the tenth progression of all the rest of the Characters contained in the number proposed.

Explication.

Let the Number propounded be 75687138713078976. Then according to this definition, the first Character 6, maketh sixe: and the 7 following seuentie: and the 2 following, two hundred: and the 9, nine thousand: and so of the rest. To expresse this number, place euer ouerthwart the first Character of each Member (except the first Member) a pricke or point, as you see aboue: then say, seuen hundred fiftie sixe thousand thousand thousand thousand thousand, (namely, so many times thousand, as there are prickes or points from 7 to the end) eight hundred seuentie one thousand thousand thousand thousand, three hundred eightie seuen thousand thousand thousand, one hundred thirty thousand thousand, seuen hundred eightie nine thousand, two hundred seuenty sixe.

The sixt Definition.

A whole number is either a vnitie, or a compounded multitude of vnities.

The seuenth Definition.

The Golden Rule, or Rule of three, is that by which to three tearmes giuen, the fourth proportionall tearme is found.

The operation of Arithmeticall whole Numbers.

Of the Addition of whole Numbers.

The first Probleme.

ARithmeticall whole numbers being giuen to finde their Summe, Explication propounded, let the Numbers giuen to be added, be 379, and 7692, & 4545. Explication required, to find their summe. Contruction: the Numbers giuen, shall be disposed as followeth: so as their first Characters towards the right hand, stand directly one vnder another: and likewise their second Characters, and so also the rest following, drawing vnder them a line: then shall all the Characters of the first ranke towards the right hand be added, saying, 9 and 2 make 11, and 5 make 16, whereof the 6 shall be placed vnder the first ranke, and the 1 of the same 16, shall be added to the second ranke, saying, 1 and 7 make 8, and 9 make 17, and 4 make 21. of whiche the 1 shall be placed directly vnder the second ranke, and the 2 shall be added to the third ranke, saying, 2 and 3 make 5, and 6 make 11, and 5 make 16, whereof the 6 shall be placed vnder the third ranke, and the 1 shall be ad-

379
7692
4545
12516

ded to the fourth, saying, 1 and 7 make 8, and 4 make 12, which shall be wholly placed in their ranke thus.

I say, 12616 is the summe required.

Numbers given.	379
	7692
	4545
Summe.	12616

Demonstration: if from the three Numbers given, the two first be taken away, and there remaineth 4545: and if from the Summe 12616, the two first given be substracted also, there remaineth likewise 4545: But by the common Axiom, if from things equall, equall things bee substracted, their rests shall be equall: And things substracted equall to things substracted, all shall be equall. Therefore, 12616 is equall to three Numbers given, which is the thing required. Conclusion: Arithmeticall whole Numbers being given to be added, we have found their summe as was required.

Substraction of whole Numbers.

The second Probleme.

AN Arithmeticall whole Number being given, out of which to substract, and another Arithmeticall whole Number to bee substracted: to finde their Rest.

Explication propounded, bee the Number out of which to substract, 238754207: And the number to be substracted 71572604 given. Explication required to finde their Rest. Construction: the Number to be substracted, shall be replaced under the Number out of which it is to bee substracted,

stracted, as that the 4 stand directly under the 7, and the 0 under the 0, and so of the rest, drawing a line betweene the numbers given, and another under the number which is to be substracted, as hereunder appeareth. Then beginning at the right hand, substract 4 from 7, and there resteth 3, which shall be set directly under the 4, and then say, 0 out of 0 resteth 0, placing 0 under the 0: then 6 from 2, which being impossible, say, 6 from 10, and 2 (which is 12) resteth 6, placing that under the 6: then 2 from 3, (true it is that you should haue said 2 from 4, had it not been that you borrowed 1 from the 4 to make the other 2 to value 12) resteth 1, placing that under the 2: and so of all the other. The disposition of their Characters are as here appeareth. I say that 167181603 is the Rest required. Demonstration: adding the Rest 167181603 to the number to be substracted 71572604, the summe shall be equall to the number from which the substraction was made: wherefore seeing that 167181603 is the difference betweene the number from which the substraction was made, and the number to be substracted; therefore that is their Rest which was to be demonstrated. Conclusion. An Arithmeticall whole Number from which to be substracted, and another to substract, being given, we haue found their Rest which was required.

Number out, &c.	238754207
Number to be, &c.	71572604
Rest.	167181603

Multiplication of whole Numbers.

The third Probleme.

AN Arithmeticall whole Number given to be multiplied, and another to multiply, to find their product.

Explication propounded: Be the Multiplicand

or Number to be multiplied 546, and the Multiplicator or number to multiply 37. Explication required: To finde their product, Note, that for the more easie solution of this proposition, it were necessary to haue in memory the multiplication of the 9 simple Characters among themselues, learning them by rote out of the Table here placed, seeking the Multiplicand in the superior line of squares, and the Multiplicator in the diagonall or slope line of squares: and in the common Angle answering them both, you shall find their product.

Pythagoras Table.

1	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	9	12	15	18	21	24	27	
4	16	20	24	29	32	36		
5	25	30	35	40	45			
6	36	42	48	54				
7	49	56	63					
8	64	72						
9	81							

As we would know ye product of 3 and 8, seeke 8 in ye vpper line, and 3 in the slope or diagonall: and in the common Angle you shall find 24 their product, and so of all the rest, as by the Table will plainely appeare.

Construction: place the first numbers on the right hand (of the given) one directly vnder another, and then draw a line, as heere-vnder is done. Then say, 7 times 6 make 42, place 2 vnder the 7, and retaine the 4 (because of the 4 tenths) in memorie: then say, 7 times 4 make 28, and the 4 which you had in minde, make 32, whereof place the 2 vnder the 3, and retaine 3, and say, 7 times 5 make 35, and 3 which was borne in minde, make 38, which

which shall be placed in order under the line, as you see. In the like sort shall the 546 bee multiplied by the 3 of the multiplicator, saying, 3 times 6 make 18, placing the 8 under the 3: and so of the rest. Then shall bee drawne a line, adding all that is betweene by two lines in this sort.

Multiplicand.	546
Multiplicator.	37
	3822
	1638
Product.	20202

I say, that 20202 is the Product required.

Demonstration. The 20202 containeth the 37 so many times as there is unities in the 546: therefore 20202 is the product which was to be found. Conclusion. An Arithmetical whole number being given to be multiplied, and another to multiply, we have found their required product.

Diuision of Arithmeticall *whole Numbers.*

The fourth Probleme.

AN Arithmeticall whole Number being given to be divided, and another to divide, to finde their Quotient.

Explication propounded: The number to bee divided, 995, and the number to divide, 28 given. Explication required: to finde their Quotient. Construction: The number to be divided (or dividend) and the number to divide (or divisor) shall bee placed in order, having a croked line, as hereunder followeth, saying, how many times 2 in 9? three times, (true it is that there are 4 times 2 in 9, and 1 remaining) but wee will shew by rea-

ſion hereafter why we muſt ſay but three times) ſet downe 3 for the firſt Character of the Quotient, behynd the crooked line, and the 3 remayning of the 9 cancelling the 2 & 9: then multiply 8 by the diuiſor, by 3, the Quotient it maketh 24, which ſubſtract frō 39 (here appeareth the occaſion why we ſayd that 2 is but onely 3 times in 9: for if we had ſayd 4 times, reſting of the 9, and had multiplied 8 by 4 it would haue bene 32 which ſhould be ſubſtracted from 19 which then remayned of the diuident, which is impoſſible; therefore there muſt be ſuch a number taken, & placed behind the crooked line, as that the product thereof may be ſubſtracted from the remaynder) reſteth 15, which place ouer 39, cancelling the 39, and the 8, ſo ſhall the diſpoſition of the Characters be in this manner.

Now to finde the ſecond Character of the Quotient, the diuiſor muſt againe be ſet vnder the diuident, placing the 8 of the diuiſor vnder the 5 of the diuident, and the 2 vnder the 8, ſaying how many times 2 in 15? fiue times, which 5 ſhalbe placed neere the 3 at the obliqus line, for the ſecond Character of the Quotient reſteth 5 which ſhalbe placed ouer the 5 of the 15 cancelling the ſayd 15 and 2: then multiplying the diuiſor 8 by the Quotiēt 5 maketh 40, which ſubſtract from 55 remayneth 15, cancelling the 55 and the 8 and diſtinguiſhing the 15 with crooked lines from the other Characters: then drawe a line neere the Quotient 35, placing ouer the ſame the ſayd remaynder, and vnder the ſame the diuiſor 28, and the diſpoſition of the Characters will be as appeareth aboue, I ſay that $35\frac{15}{28}$ is the Quotient required.

Demonſtration: the $35\frac{15}{28}$ containeth the vnity ſo often as the 995 containeth the diuiſor 28: therefore $35\frac{15}{28}$ is the Quotient required which was to be demonſtrated, Concluſion: an Arithmeticall whole number for diuident,

dent, and one for diuisor giuen, we haue found their Quotient required.

The Rule of Three, or Golden Rule of Arithmeticall whole *Numbers*.

The fift Probleme.

THree Termes of Arithmeticall Numbers, being giuen to finde their proportionall Terme.

Explication propounded: Be the three termes giuen 2 3 4. Explication required: To finde their fourth proportionall Terme: that is to say, in such Reason to the third terme 4, as the second terme 3, is to the first terme 2. Construction: Multiply the second terme 3, by the third terme 4, ỳ gineth the product 12: which diuiding by the first terme 2, gineth the Quotient 6: I say that 6 is the fourth proportionall terme required. Demonstration: there is from 6 to 4, Reason sesquialter, and the same Reason is there from 3 to 2: therefore 6 is the fourth proportionall terme to be demonstrated. Conclusion: three Arithmeticall numbers being giuen, wee haue found their fourth proportionall terme required.

The Preface of Simon Steuin.

To Aſtronomers, Land-meaters, Meaſurers of Tapiſtry, Gaudgers, Stereometers in generall, Monty-Maſters, and to all Marchants, Simon Steuin wiſheth health.

MAny ſeeing the ſmalnes of this Book, and conſidering your worthynes to whō it is dedicated, may perchance eſteeme this our conceyte abſurd: But if the proportion be conſidered, the ſmall quantity hereof compared to humane imbecility, and the great vtility vnto high and ingenious intendiments, it will be found to haue made compariſon of the extreame teatmes, which permit not any conuerſion of proportion. But what of that? is this an admirable inuention? No certainly: for it is ſo meane, as that it ſcant deſerueth the name of an inuentiō: for as the coūtryman by chance ſometime findeth a great treaſure, without any vſe of ſkill or cunning, ſo hath it hapned herein. Therefore if any will thinke, that I vaunt my ſelfe of my knowledge, becauſe of the explicatiō of theſe vtilities, out of doubt, he ſheweth himſelfe to haue neyther iudgemēt, vnderſtanding, nor knowledge to diſcerne ſimple

ſimple things from ingenious inuentions, but he (rather) ſeemeth enuious of the common benefite: yet howſoeuer, it were not fit to omit the benefit hereof, for the inconuenience of ſuch calumny. But as the Mariner hauing by hap found a certaine vnknowne Iſland, ſpareth not to declare to his Prince the riches and profits thereof; as the fayre fruits, precious mineralls, pleaſant champions, &c. and that without imputation of Philautry: euen ſo ſhall we ſpeake freely of the great vſe of this inuention; I call it great, being greater then any of you expect to come from me. Seeing then that the matter of this Diſme (the cauſe of the name whereof ſhalbe declared by the firſt definition following) is number, the vſe and effects of which, your ſelues ſhall ſufficiently witnes by your continuall experiences, therefore it were not neceſſary to vſe many words thereof: for the Aſtrologer knoweth, that the world is become by computation Aſtronomicall (ſeing it teacheth the Pilot the eleuation of the Equator and of the Pole, by meanes of the declination of the Sunne, to deſcribe the true Longitudes, Lãtitudes, ſituatiõs & diſtances of places, &c.) a Paradiſe, aboũding in ſome places with ſuch things as the Earth cannot bring forth in other. But as the ſweet is neuer without the ſowre: ſo the trauayle in ſuch computations cannot be vnto him hidden, namely, in the buſy multiplications and diuiſions which proceed of the 60 progreſſion of degrees, minutes, ſeconds, thirds, &c. And the Surueyor or Land-meater knoweth, what great benefite the world

receyueth from his ſcience, by which many diſſenſions and difficulties are auoyded, which otherwiſe would ariſe by reaſon of the vnknowne capacity of Land: beſides, he is not ignorant (eſpecially whoſe buſines and imployment is great) of the troubleſome multiplications of Roods, Feete, and oftentimes of ynches, the one by the other, which not onely moleſteth, but alſo often (though he be very well experienced) cauſeth error, tending to the dãmage of both parties, as alſo to the diſcredit of Land-meater or ſurueyor, and ſo for the Money-maſters, Marchants and each one in his buſines: therefore how much they are more worthy, and the meanes to attayne them the more laborious, ſo much the greater and better is this Diſme, taking away thoſe difficulties: But howe? it teacheth (to ſpeake in a word) the eaſy performance of all reckonings, computations, & accounts, without broken numbers, which can happen in mans buſines, in ſuch ſort, as that the foure Principles of Arithmetick namely, *Addition, Subſtractiõ, Multiplication, & Deuiſiõ*, by whole numbers, may ſatiſfie theſe effects, affording the like facility vnto thoſe that vſe Coũters. Now if by thoſe meanes wee gaine the time which is precious, if hereby that be ſaued which otherwiſe ſhould be loſt, if ſo, the paines, controuerſy, error, dammage, and other inconueniences commonly hapning therin, be eaſed, or taken away, then I leaue it willingly vnto your iudgements to be cenſured: and for that, that ſome may ſay that certaine inuentions at the firſt ſeeme good, which when they come to be practized,

effect

effect nothing of worth, as it often hapneth to the serchers of strong mouing, which seeme good in small proofes and modells, when in great, or comming to the effect, they are not worth a Button: whereto we answere, that herein is no such doubt: for experience dayly sheweth the same: namely, by the practize of diuers expert Land-meaters of *Holland*, vnto whom we haue shewed it, who (laying aside that which each of them had, according to his owne manner, inuented to lessen their paines in their computations) do vse the same to their great contentment, and by such fruit as the nature of it witnesseth, the due effect necessarily followeth: The like shall also happen to each of your selues vsing the same as they doe: meane while liue in all felicity.

The Argument.

THe Disme hath two parts, that is, Definitions & Operations: by ẏ first definition is declared what Disme is, by the second, third, and fourth, what Comencement, Prime, Second &c. and Disme numbers are: the Operation is declared by foure propositions, The Addition, Substraction, Multiplication and Deuision of Disme numbers. The order whereof may be successiuely represented by this Table.

- The Disme hath two parts.
  - Definitions, as what is
    - Disme,
    - Comencement,
    - Prime, Second &c.
    - Disme nomber.
  - Operations or Practize of the
    - Addition,
    - Substraction,
    - Multiplication,
    - Deuision.

And to ẏ end the premises may ẏ better be explained, there shalbe hereunto an Appendix annexed, declaring the vse of the Disme in many things by certaine examples, and also definitions and operations, to teach such as doe not already know the vse and practize of Numeration, and the foure principles of common Arithmetick, in whole numbers, namely, Addition, Substraction, Multiplication, & Division, together with the Golden Rule, sufficient to instruct the most ignorant in ẏ vsuall practize of this Art of Disme or Decimall Arithmeticke.

The first Part.

Of the Definitions of the Dismes.

The first Definition.

DIsme is a kind of Arithmeticke, inuented by the tenth progression, consisting in Characters of Cyphers; whereby a certaine number is described, and by which also all accounts which happen in humane affayres, are dispatched by whole numbers, without fractions or broken numbers.

Explication.

LEt the certaine number be one thousand, one hundred and eleuen, described by the Characters of Cyphers thus 1.1 1 1, in which it apeareth that each 1 is the 10th part of his precedent character 1: likewise in 2 7 8, each vnity of 8 is the tenth of each vnity of 7, and so of all the others: But because it is conuenient that the things whereof we would speake, haue names, and that this maner of

computation

computation is found by the consideration of such tenth or disme progression; that is, that it consisteth therein entirely, as shall hereafter appeare: Wee call this Treatise fitly by the name of Disme, whereby all accounts happning in the affayres of men, may be brought and effected without fractions or broken numbers, as hereafter appeareth.

The second Definition.

Every number propounded, is called Comencement, whose signe is thus (°).

Explication.

By example, a certaine number is propounded of three hundred sixty foure: we call the 364 Comencements, described thus 364 (°) and so of all other like.

The third Definition.

As to each tenth part of the unity of the Comencement, wee call the Prime, whose signe is thus (1), and each tenth part of ỳ unity of the Prime, we call the Second, whose signe is (2), and so of ỳ other: each tenth part of the unity of the precedent signe, alwayes in order, one further.

(0)(1)(2)(3)

Explication.

As 3 (1) 7 (2) 5 (3) 9 (4) that is to say, 3 Primes, 7 Seconds, 5 Thirds, 9 Fourths, and so proceeding infinitely: but to speake of their value, you may note, that according to this definition, the layd numbers are $\frac{3}{10}$ $\frac{7}{100}$ $\frac{5}{1000}$ $\frac{9}{10000}$, together $\frac{3759}{10000}$ and likewise 8 (0) 9 (1) 3 (2) 7 (3) are worth $8\frac{9}{10}\frac{3}{100}\frac{7}{1000}$ together $8\frac{937}{1000}$ and so of other like.

Also you may understand, that in this Disme we use no

fractions, and that the multitude of signes, except (0) neuer exceede 9: as for example, not 7 (1) 12 (2) but in their place 8 (1) 2 (2), for they valew as much.

The fourth Definition.

The numbers of the second and third Definitions beforegoing, are generally called Disme numbers.

The end of the Definitions.

The second part of the Disme.

Of the Operation or Practize.

The first proposition of Addition.

Disme numbers being giuen how to adde them to find their summe.

The explication propounded; there are 3 orders of Disme numbers giuen, of which the first 27 (0), 8 (1), 4 (2), 7 (3), the second 37 (0), 8 (1), 7 (2), 5 (3), the third 875 (0), 7 (1) 8 (2), 2 (3). The explication required, we must find their totall summe.

Construction.

The numbers giuen, must be placed in order as here adioyning, adding them in the vulgar maner of adding of whole numbers in this maner: The summe (by the first Probleme of Arithmetick following) is 941504, which are (that which the signes aboue the numbers do shew) 941 (0) 5 (1) 0 (2) 4 (3). I say, they are the summe required. Demonstration; the

(0)	(1)	(2)	(3)
2	7	8	4	7
3	7	8	7	5
8	7	5	7	8	2
9	4	1	5	0	4

$27(^0)8(^1)4(^2)7(^3)$ giuen, make by the 3 Definition before $27\frac{8}{10}\frac{4}{100}\frac{7}{1000}$, together $27\frac{847}{1000}$, and by the same reason, the $37(^0)8(^1)7(^2)5(^3)$ shall make $37\frac{875}{1000}$, and the $875(^0)7(^1)8(^2)4(^3)$ will make $875\frac{782}{1000}$, which three numbers make by common addition of vulgar Arithmeticke $941\frac{304}{1000}$: But so much is the summe $941(^0)5(^1)0(^2)4(^3)$: therefore it is the true summe to be demonstrated. Conclusion: Then Disme numbers being giuen to bee added, wee haue found their summe, which is the thing required.

Note, that if in the number giuen, there want some signes of their naturall order, the place of the defectant shal be filled. As for example, let the numbers giuen bee $8(^0)5(^1)6(^2)$ and $5(^0)7(^2)$: in which, the latter wanted the signe of $(^1)$, in the place thereof shall $0(^1)$ bee put, take then for that latter number giuen $5(^0)0(^1)7(^2)$ adding them in this forme.

	$(^0)$	$(^1)$	$(^2)$
	8	5	6
	5	0	7
1	3	6	3

This aduertisement shall also serue in the three following propositions, wherein the order of the defayling figures must be supplied, as was done in the former example.

The second Proposition.

Of Substraction.

A Disme number being giuen to substract: another lesse Disme number giuen out of the same to finde their rest.

Explication propounded: be the numbers giuen 237 (°) 5 (¹) 7 (²) 8 (³) & 59 (°) 7 (¹) 3 (²) 9 (³) The Explicatiõ required; to find their reſt.

Conſtruction: the numbers giuen ſhalbe placed in this ſort, ſubſtracting accoꝛding to vulgar maner of ſubſtractiõ of whole nũbers, thus

(°)	(¹)	(²)	(³)
2	3	7	5 7 8
	5	9	7 3 9
1	7	7	8 3 9

The reſt is 177839 which valueth as the ſignes ouer them do denote 177 (°) 8 (¹) 3 (²) 9 (³), I affirme ẏ ſame to be the reſt required.

Demonſtration: the 237 (°) 5 (¹) 7 (²) 8 (³) make by the third Definition of this Diſme, $237\ \frac{5}{10}\ \frac{7}{100}\ \frac{8}{1000}$ together $237\ \frac{578}{1000}$ and by the ſame reaſon, the 59 (°) 7 (¹) 4 (²) 9 (³) valne $59\ \frac{749}{1000}$ which ſubſtracted from $237\ \frac{578}{1000}$ there reſteth $177\ \frac{830}{1000}$ but ſo much doth 177 (°) 8 (¹) 3 (²) 9 (³) value: that is then the true reſt which ſhould be made manifeſt. Concluſion: a Diſme being giuen, to ſubſtract it out of another Diſme number, and to know the reſt, which we haue found.

The third Propoſition: of Multiplication.

A Diſme number being giuen to be multiplied, and a multiplicatoꝛ giuen to find their pꝛoduct:

The Explication propounded: be the number to be multiplied 32 (°) 5 (¹) 7 (²), and the multiplicatoꝛ 89 (°) 4 (¹) 6 (²)

The Explication required: to find the pꝛoduct. Conſtruction: the giuen numbers are to be placed as here is ſhewed, multiplying accoꝛding to the vulgar maner of multiplicatiõ by whole nũbers, in this maner,

(9)	(¹)	(²)
3	7	5 7
8	9	4 6
1	9	5 4 2
1	2	0 2 8
2	3	1 3
2	6	0 5 8

giuing

giuing ỹ prodúct, 2913 7122: Now 2913712 2
to know how much they value, ioyne (°)(1)(2)(3)(4)
the two last signes together as the one (3) and the other (2) also, which together make (4), and say ỹ the last signe of the prodúct shall be (4) which being knowne, all the rest are also knowne by their continued order. So that the prodúct required, is 2913 (°) 7 (1) 1 (2) 2 (3) 2 (4).

Demonstration: The number giuen to be multiplyed, 32 (°) 5 (1) 7 (2) (as appeareth by the third Definition of this Disme) 32 $\frac{5}{10}$ $\frac{7}{100}$ together 32 $\frac{57}{100}$: and by the same reason the multiplicator 89 (°) 4 (1) 6 (2) value 89 $\frac{46}{100}$ by the same, the said 32 $\frac{57}{100}$ multiplied, giueth the prodúct 2913, $\frac{7122}{10000}$ But it valueth 2913 (°) 7 (1) 1 (2) 2 (3) 2 (4). It is then the true prodúct which we were to demonstrate. But to shew why (2) multiplied by (2) giueth the prodúct (4) which is the summe of their numbers, also why (4) by (5) produceth (9), and why (°) by (3) produceth (3) &c. Let vs take $\frac{2}{10}$ and $\frac{3}{100}$ which (by the third Definition of this Disme) are 2 (1) 3 (2) their prodúct is $\frac{6}{10000}$ which value by the said third Definition 6 (3), multiplying then (2) by (2) the prodúct is (3) namely a signe compounded of the summe of the numbers of the signes giuen.

Conclusion.

A Disme number to multiply, and to be multiplyed, being giuen, we haue found the prodúct, as we ought.

Note.

IF the latter signe of the number to bee multiplyed, bee vnequall to the latter signe of the multiplicator, as for example, the one 3 (4) 7 (1) 8 (6), the

other 5 (1) 4 (2), they shal be handled as aforesayd, and the disposition thereof shalbe thus. (4)(5)(6)

3 7 8
5 4 (2)
1 5 1 2
1 8 9 0
2 0 4 1 2
(4)(5)(6)(7)(8)

The fourth Proposition: of Diuision.

A Disme number for the diuident, and diuisor, being giuen to find the Quotient.

Explication proposed: let the number for the diuident be 3 (0) 4 (1) 4 (2) 3 (3) 5 (4) 2 (5) and the diuisor 9 (1) 6 (2). Explication required: to find their Quotient.

CONstruction: the numbers giuen diuided (omitting the signes) according to the vulgar maner of diuiding of whole numbers, giueth the Quotient, 3587; now to know what they value; the latter signe of the diuisor (2) must be subtracted from the latter signe of the diuident which is (5), resteth (3) for the latter signe of the latter Character of ẏ Quotient, which being so knowne, all ẏ rest are also manifest by their continued order, thus 3 (0) 5 (1) 8 (2) 7 (3) are the Quotient required.

DEmonstration: the number dinident giuen 3 (0) 4 (1) 4 (2) 3 (3) 5 (4) 2 (5) maketh (by the third Definition of this Disme) $3\frac{4}{10}\frac{4}{100}\frac{3}{1000}\frac{5}{10000}\frac{2}{100000}$ together $3\frac{44352}{100000}$ and by ẏ same reason, the diuisor 9 (1) 6 (2) valueth $\frac{96}{100}$, by which $3\frac{44352}{100000}$ being diuided, giueth the Quotient $3\frac{587}{1000}$; but the sayd Quotient valueth 3 (0) 5 (1) 8 (2) 7 (3): therefore it is the true Quotient to be demonstrated.

Conclusion: a Disme number being giuen for the diuident,

tent and diuisor, we haue found the Quotient required.

Note, if the diuisors signes be higher then the signes of the diuident, there may be as many such Cyphers ioyned to the diuident as you will, or many as 3 2 shalbe necessary: as for example, 7 (2) 7000 (1750(7) are to be diuided by 4 (3), 3 place after 4444 the 7 certaine o thus 7000, diuiding them as aforesayd, & in this sort it giueth for the Quotient 1750(7).

It happeneth also sometimes, that the Quotient cannot be expressed by whole numbers, as 4 (1) diuided by 3 (2) in this sort, XXX (1 (0)(1) (2) whereby 4000000 (1 3 3 3 appeareth, 3333

that there will infinitly come from the 3 the rest of $\frac{1}{3}$ and in such an accident you may come so neere as the thing requireth, omitting the remaynder, it is true, that 1 3 (0) 3 (1) 3 $\frac{1}{3}$ (2) &c. shalbe the perfect Quotient required: but our intention in this Diſme is to worke all by whole numbers: for seing that in any affayres, we reckon not of the thousandth part of a mite, grayne, &c. as the like is also vsed of the principall Geometricians, and Astronomers, in cõputations of great consequence, as Ptolome & Iohannes Monta-regio haue not described their Tables of Arches, Chords, or Sines, in extreme perfection (as possibly they might haue done by Multinomall numbers,) because that imperfection (considering the scope and end of those Tables) is more conuenient then such perfection.

Note 2. the extraction of all kinds of Roots may also be made by these Diſme numbers: as for example, I extract the square roote of 5 (2) 2 (3) 9 (4), which is performed in the vulgar maner of extraction in this sort, and the root shalbe 2 (1) 3 (2), for the moitye of

1
5 2 9
2 3
4

halfe of the latter ſigne of the numbers giuen, is alwayes the latter ſigne of the roote: wherefore if the latter ſigne giuen were of a number imper: the ſigne of the next following ſhalbe added, and then it ſhalbe a number per: and then extract the Root as afore. Likewiſe in the extraction of the Cubique Roote, the third part of the latter ſigne giuen ſhalbe alwayes the ſigne of the Roote: and ſo of all other kind of Roots.

The end of the Diſme.

The Appendix.

The Preface.

SEing that we haue already deſcribed the Diſme, we will now come to the vſe thereof, ſhewing by vi. Articles, how all computations which can happen in any mans buſines, may be eaſily performed thereby: beginning firſt to ſhew how they are to be put in practize, in the caſting vp of the content or quantity of Land meaſured as followeth.

The firſt Article, of the Computations of *Land-meating.*

CAll the Pearch or Rood alſo Comencement, which is I (°), diuiding that into 10 equall parts, whereof each one ſhalbe I (′); the diuide each prime againe into

into 10 equall parts, each of which shalbe 1 (²), and againe each of them into 10 equall parts, and each of them shalbe 1 (³); proceeding further so, if neede be; but in Land-mating, divisions of seconds wilbe small enough: yet for such things as require more exactnes, as Fathoms of the Lead, Bodyes &c. there may be thirds vsed: and for as much as the greater number of Land-meaters vse not the Pole, but a chayne line of three, foure or five Perch long, marking vpon the yarn of their crosse staffe certaine feete 5 or 6 with fingers, palmes &c. the like may be done here: for in the place of their five or sixe feete with their fingers, they may put 5 or 6 primes with their seconds.

THis being so prepared, there shalbe vsed in measuring, without regarding the feete and fingers of the Pole, according to the Custome of the place: & that which must be added, substracted, multiplied or divided according to this measure, shalbe performed according to the doctrine of the precedent examples.

As for example, we are to adde 4. Tryangles or Surfaces of Land, whereof the first 345 (°) 7 (¹) 2 (²), the second 872 (°) 5 (¹) 3 (²), the third 615 (°) 4 (¹) 8 (²) & fourth 956 (°) 8 (¹) 6 (²);

(°)	(¹)	(²)
3	4	5 7 2
8	7	2 5 3
6	1	5 4 8
9	5	6 8 6
2	7	9 0 5 9

These being added according to the manner declared in the first Proposition of this Disme in this sort, their summe will be 2790 (°) or Perches 5 (¹) 9 (²), the said Roods or Perches, divided according to the custome of the place; (for every Acre containeth certaine Perches) by the number of perches you shall haue the Acres sought.

BVt if one would know how many feete and fingers are in the 5 (¹) 9 (²) (that which Land-meater shall need to doe but once, and that at the end of the casting vp of the proprietaries, although most men esteeme it vnnecessary to make any mention of feete and fingers) it will appeare

vpon the Pole how many feete and fingers (which are marked, foyning the tenth part vpon another side of the Rood) accord with themselues.

In the second, out of 57 (°) 3 (ˈ) 2 (ˈˈ) substracted 32 (°) 5 (ˈ) 7 (ˈˈ) it may be effected according to the second proposition of this Disme, in this maner:

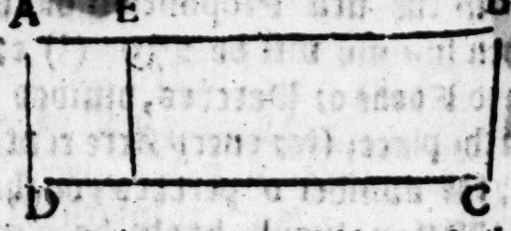
5 7 3 2
3 3 5 7
2 4 7 5

In the third (for multiplication of the sides of certaine Triangles and Quadrangles) multiply 8 (°) 7 (ˈ) 3 (ˈˈ), by 7 (°) 5 (ˈ) 4 (ˈˈ) 2 this may be performed according to the third proposition of this Disme, in this manner:

(°) (ˈ) (ˈˈ)
8 7 3
7 5 4
3 4 9 2
4 3 6 5
6 1 1 1
6 5 8 2 4 2
(°) (ˈ) (ˈˈ) (ˈˈˈ) (ˈⁿ)

And giueth for the product or superfices 65 (°) 8 (ˈ) &c.

In the fourth let A, B, C, D, be a certaine Quadrangle Rectangular (from which we must cut 367 (°) 6 (ˈ) and the side A D: maketh 26 (°) 3 (ˈ): The question is, how much we shall measure from A, towards B, to cut off, (I meane by a line parallell to A D) the ratio 367 (°) 3 (ˈ).



Deuide 367 (°) 6 (ˈ) by 26 (°) 3 (ˈ) according to the fourth proposition of this Disme: so the Quotient giueth from A, towards B, 13 (°) 9 (ˈ) 7 (ˈˈ), which is A E.

And if wee will, wee may come nearer (although it be needles) by the second note of the fourth Proposition, the

the demonstrations of all these examples are alreadie made in their propositions.

(1
2 2
7 6
2 5 0 (8
4 6 3 1
1 0 4 7 3 (9 (°)(¹)(²)
3 6 7 6 0 0 | 1 3 9 7
2 6 3 3 3 3
2 6 6 6
2 2

The II. Article: of the Computations of the measures of Tapistry, or Cloth.

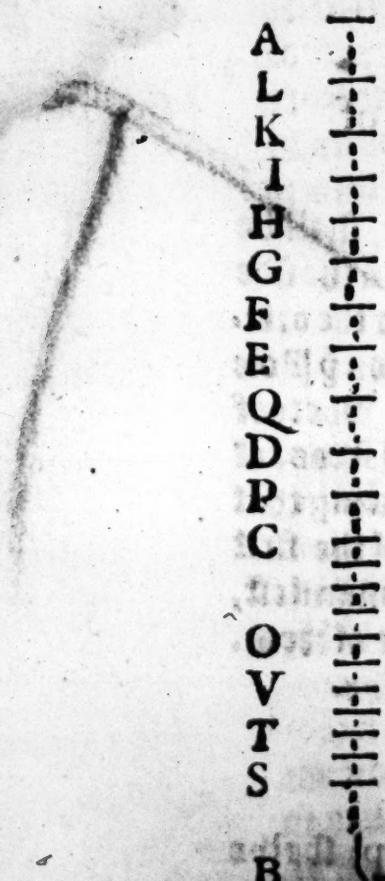
THe Ell of the Measurer of Tapistrie or cloth, shall be to him 1 (°), the which he shall deuide (vpon the side whereon the partitions, which are according to the ordinance of ỹ Towne, is not set out) as is done about on ỹ Pole of ỹ Land meater, namely into 10 equall parts, whereof each shall be 1 (°), then each 1 (¹) into 10 equall partes, of which each shall be 1 (²) etc. And for the practise leaving that these examples doe altogether accord with those of the first Article of Landmeating, it is thereby sufficiently manifest, so as we need not here make any mention againe of them.

The III. Article: of the Computations, seruing to Gaudging, and the measures of all Liquor vessels.

ONe Ame (which maketh 100 pots Antwerp) shalbe 1 (°), the same shall be deuided in length and depnes, into 10 equall parts (namely, equall in respect of the mine, not of the Rod; of which the parts of the profunditie shalbe inequall) each part shalbe 1 (¹) containing 10 pots, then again each 1 (¹) into 10, parts equal as afore, and each will make 1 (²) worth 1 pot, then each 1 (²) into 10. equal parts making each 1 (³).

Now the Rod being so deuided, to know the content of the Tunne, multiply and worke as in the precedent first Article, of which (being sufficiently manifest) we will not speake here any farther.

But seing that this tenth diuision of the deepnes is not vulgar, wee will explaine the same. Let the rod bee one Ame. A. B. which is 1 (°) deuided (according to the custome) into the points of the deepnes of these nine:



C, D, E, F, G, H, I, K, A, making each part 1 (1) which shall bee againe each part deuided into 10. thus. Let each 1 (1) bee deuided into two ſs: draw the line, B M. with a right angle vpon A B. and equall to 1 (1), B C, then (by the 13 proposition of Euclid his 6: booke) find the meane proportionall betweene B M and his moytie, which is B N: cutting B O: equall to B N: And if N O: bee equall to B C: the operation is good. Then note the length N C: from B towards A, as B P: the which being equall to N C: the operation is good: likewise the length of B N: from B to Q: and so of the rest.

If remaine th yet to deuide each length as B O & O C, &c. into fine, thus: Seeke the meane proportionall betweene B M: & his 10 part which shalbe B R: cutting B S: equal to B R: Then the length S R. noted from B towards A: as B T: and likewise the length T R: from B to V: & so of the others: & in like sort proceeding to deuide B S: and S T: &c. into (3), I say that B S: S T: and T V: &c. are

are the desired (2) which is thus to bee demonstrated.

For that B N: is the meane proportionall line (by the Hipothesis betweene B M: and his moytie, the square of B N: (by the 17. proposition of the first booke of Euclide) shalbe equall to the Rectangle of B M: & his moytie: But the same Rectangle is the moytie of ỹ square of B M: the square then of B N: is equall to the moytie of the square of B M: But B O is (by Hipothesis) equall to B N: and B C: to B M: the square then of B O: is equall to the moitie of the square of B C. And in like sort it is to be demonstrated, that the square of B S is equall to the tenth part of the square of B M. Wherefore &c. we haue made the demonstration briefe, because wee write not this to learners, but vnto maisters in their science.

The IIII. Article: of Computations of Stereometrie in generall.

TRue it is, that Gaudgerie which we haue before declared, is Stereometrie (ỹ is to say, the Art of measuring of bodies) but considering the diuers diuisions of the Rod, Yard, or Measure of the one and other, and that and this bee so much differ, as the Genus and the Species: they ought by good reason to be distinguished. For all Stereometrie is not Gaudgerie. To come to the point, the Stereometrian shall vse the measure of the towne or place, as the Yard, Ell &c. with his temne partitions, as is described in the first and second Articles, the vse and practise thereof, (as is before shewed) is thus: Put case wee haue a Quadrangular, Rectangular Columne to bee measured, the length whereof is 3 (1) 2 (2), the breadth 2 (1) 4 (2), the height 2 (0) 3 (1) 5 (2), The question is, how much the substance or matter of that Piller is: Multiply (according to the doctrine of the 4. proposition of this Disme) the length by the breadth, & the product again by the height in

this manner,

And the product appeareth to be 1 (1) 8 (2) 4 (4) 8 (1).

(1)(2)
3 2
2 4
1 2 8
6 4
7 6 8 (4)
2 3 5 (2)
3 8 4 0
2 3 0 4
1 5 3 6
1 8 0 4 8 0
(3)(6)

NOte, some ignorant (and vnderstanding not that wee speake here) of the Principles of Stereometry, may maruayle wherefore it is sayd, that the greatnes of yaboue-said colūn is but 1 (1) &c. seing that it cōtayneth more then 180 cubes, of which the length of each side is 1 (1), he must know that the body of one yard is not a body of 10 (1) as a yard in length, but 1000 (1) in respect whereof 1 (1) maketh 100 Cubes, each of 1 (1) as the like is sufficiently manifest amongst Land-meats in surfaces: for when they say 2 Roodes, 3 Feete of Land, it is not barely meant 2 square Roods, and three square feete, but two Roods (and counting but 12 feete to the Rood) 36 feete square: therefore if the sayd Question had beene how many Cubes each being 1 (1) was in the greatnes of the sayd Piller, the solution should haue bene fitted accordingly, considering that each of these 1 (1) doth make 100 (1) of those; and each 1 (2) of these maketh 10 (1) of those &c. or otherwise, if the tenth part of the yard be the greatest measure that the Stereometrian proposeth, he may call it 1 (0), and so as aboue-sayd.

The

The fift Article; of Astronomicall Computations.

THe ancient Astronomers hauing diuided their Circles each into 360 degrees, they saw, that the Astronomicall Computations of them with their parts was too laborious: and therefore they diuided also each degree into certaine parts, and those againe into as many, &c. to the end thereby to worke alwayes by whole numbers, chusing the 60th progression, because that 60 is a number measurable by many whole measures, namely, 1, 2, 3, 4, 5, 6 10, 12, 15, 20, 30: but if experience may be credited (we say with reuerence to the venerable antiquity, and moued with the common vtility) the 60th progression was not the most conuenient, (at least) amongst those that in nature consist differentially, but the tenth which is thus: we call the 360 degrees also Comencements, expressing them so 360 (°), and each of them a degree: 1 (°) to be diuided into 10 equall parts, of which each shall make 1 (′), and againe each 1 (′) into 10 (″) and soot the rest, as the like hath already before often done.

Now this diuision being vnderstood, we may describe more easily that we premised in Addition, Substraction, Multiplication, and Diuision; but because there is no difference betweene the operation of these, and the foure former propositions of this booke, it would but be losse of time, and therefore they shall serue for examples of this Article: yet adding thus much, that we will vse this maner of partition in all the Tables & computations which happen in Astronomy, such as we hope to diuulge in our vulgar Germane Language, which is the most rich adorned and perfect Tongue of all other, & of the most singularity, of which we attend a more abundant demonstration, then Peter and Iohn haue made thereof in the Bewysconst and Algebraique, lately diuulged, and haue in the leafe following placed a necessary Table, for the reducing of the

minutes, seconds, &c. of the 60. progression, into primes, seconds, &c. of the tenth progression: the vse whereof followeth.

The vse of this Table.

When any number of minutes, seconds, thirds, fourths &c. of the 60th progressiō, are giuen to be reduced into the primes, seconds, thirds, &c. of the tenth progression, seeke the giuen number in this Table, or if the number be not there to be found, take the neereſt: if none be there great enough, take halfe or one quarter of the giuen: if there be none small enough, double, treble, or quadruple, the giuen, and then as aforesayd seeke the neereſt number thereunto in the Table, and the two numbers in whose common Angle the giuen number is found, or neereſt found, shall shew you the quantity and quality of the subdiuisions of the ten progressions proper to that giuen number, namely, the number standing in the toppe or front of the table directly ouer it, shall shew the quantity, and the number directly against it in the first Colūmne towards the left hand, shall denote the quality; as for example, be the propounded number giuen iii iiii v, seeke it in the Table, and you shall find to 15 7 12 stand in the front directly ouer it the figure 7, and in ỹ first Columne directly against it toward the left hand (1): therefore according to the rule aboue mentioned, I conclude, that iii iiii v of the 60 progreſſion valueth iuſt 7 (1) of the 15 7 12 tenth progreſſion &c. This example I thinke sufficient to enlighten the ingenious practizer: onely this, that if there be no number to be found in the Table, iuſt or neere the number giuen, you may take two, three or more of those that will come neereſt, and so worke as before: as for example also, be the number giuen i ii iii iiii v of the 60 progreſſion; you shall find them 19 38 54 28 48 all by taking 4 of the numbers of ỹ colūne vnder 3, to be i ii iii iiii v of the tenth progreſſion: and so with a small 3 3 3 3 diligence may any other number of the one progreſſion be reduced into the other, which I omit to speake any further of at this time.

The

he sixt Article; of the Computations of Money-masters, Marchants, and of all estates in generall.

D the end we speake in generall and briefly of the sume and contents of this Article, it must be alwayes vnder-ood, ỹ all measures (be they of length, liquors, of mony &c.) parted by the tenth progression, and each notable species them, shalbe called Comencement: as a Marke, comence-ent of weight, by the which Siluer and Gold are wayed, ōd of other cōmon weights, Liuers-de gros in Flanders, und sterling in England, Ducat in Spaine &c. Comence-nt of Money: the highest signe of the Marke shalbe (4), 1 (4) shall weigh about the halfe of one Es of Antwerp, (3) shall serue for the highest signe of the Liure de gros, ng that 1 (3) maketh lesse then the quarter of one DS. The subdiuisions of weight to weigh all things, shalbe (in ce of the halfe pound, quarter, halfe quarter, ounce, fe ounce, esterlin, graine, Es, &c. of each signe 5, 3, 2, 1, t is to say, that after the pound or 1 (°) shall follow the fe pound or 5 (1), then the 3 (1) then the 2 (1) then the 1), and the like subdiuisions haue also the 1 (1) and the er following.

WE thinke it necessary, that each subdiuision, what matter soeuer the subiect be of, be called Prime, Se-nd, Third, &c. and that because it is notable vnto vs, ỹ Second, being multiplied by the Third, giueth in ỹ pro-t the Fifth (because two and three make fiue, as is said or) also the Third diuided by the Secōd, giueth ỹ Duc-t Prime &c. that which so properly cannot be done by other names: but when it shalbe named for distinction matters (as to say, halfe an Ell, halfa pound, halfe nts &c.) we may call them Prime of Marc, Second of re, Second of Pound, Second of Ell, &c.

But to the'nd wee may giue example, suppose 1 Mark

of Gold valne 36 lib. 5 (1) 3 (2) the Question what valuers 8 Marks 3 (1) 5 (2) 4 (3): multiply 3653 by 8354, giuing the product by the fourth Proposition (which is also the solution required) 305 lib. 1 (1) 7 (2) 1 (3); as for the 6 (4) and 2 (5) they are here of no estimation.

Suppose againe, 12 Ells and 3 (1) cost 3 lib. 2 (1) 5 (2) the question is, what shall 7 Ells 5 (1) 3 (2) cost: multiply according to the custome the last terme giuen by the second, and diuide the product by the first, that is to say, 753 by 325 maketh 244725; which diuided by 23, giueth the Quotient and Solution 10 lib. 6 (1) 4 (2).

WE could also more amply demonstrate by easie examples of broken numbers, the comparison and great difference of the facility of this more then that, but we will passe them ouer for brenity sake.

Lastly, it may be sayd, that there is some difference betweene this last first Article, and the 5 precedent Articles, which is, that each one may exercise for themselues the tenth partition of the said precedent 5 Articles, though it be not giuen by the Magistrate of the place and generall ouer, but it is not so in this latter: for the examples hereof, are vulgar computations, which do almost continually happen to every man, to whom it shall necessarily that the solution so found, were of each accepted for good and lawfull: Therefore considering the so great vse, it would be a commendable thing, if some of those who expect the greatest commodity, would solicit to put the same in execution to effect, namely, that toyning the vulgar partitions that are now in weight, measures, and moneyes (continuing still each Capitall measure, weight and Coyne in all places vnaltered) that the same tenth progression might be lawfully ordained by the superiors, for euery one that would vse the same: it might also do well, if the values of moneys, principally the new Coynes, might be valued and reckned vpon certayne Primes, Seconds, Thirds &c

But

But if all this be not put in practize so soone as we could wish, yet it will first content vs, if it wil be beneficiall to our successors, if future men shal hereafter be of such nature as our predecessors, who were neuer negligent of so great aduantage. Secondly, that it is not vnnecessary for each in particular, for so much as concerneth him, for that they may all deliuer them selues when they will, from so much and so great labour. And lastly, although the effects of the first Article appeare not immediatly, yet it may be; and in the meane time may each one exercise himselfe in the fiue precedent, such as shalbe most conuenient for them; as some of them haue already practized.

The end of the Appendix.